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The genus *Chiasmocleis* Méhely, 1904 (Anura, Microhylidae) in the Atlantic Rain Forest of Brazil, with description of three new species

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A taxonomic study of the species of the genus *Chiasmocleis* occurring in the Atlantic Rain Forest of eastern Brazil is presented. *Chiasmocleis bicegoi* Miranda-Ribeiro, 1920 is synonymized with *C. albopunctata* (Boettger, 1885), and rendered extralimital for the present work. The synonymization of *C. urbanae* Bokermann, 1952 with *C. leucosticta* (Boulenger, 1888) is reaffirmed. *Chiasmocleis leucosticta* and *C. schubarti* Bokermann, 1952 are redescribed, and three new species are described.

INTRODUCTION

The genus *Chiasmocleis*, proposed by MÉHELY (1904), currently contains 12 species, distributed from Panama to southern South America, north and east of the Andes (FROST, 1985). The validity of the species included in this genus has not been assessed by a modern review. Materials from the Atlantic Forests of Brazil indicate such an assessment is needed. Herein, we present a review of the species of *Chiasmocleis* inhabiting the Atlantic Rain Forest of eastern Brazil. This systematic review includes: (1) re-examination of previously described taxa; (2) redescription of the valid species; and (3) description of three new species.

MATERIALS AND METHODS

Abbreviations of the collections housing specimens are: BMNH (Natural History Museum, London, United Kingdom); CFBH (Célio F. B. HADDAD Collection, Universidade

Estadual Paulista, Rio Claro, SP, Brazil); EI (Eugênio IZECKSOHN Collection, Universidade Federal Rural do Rio de Janeiro, RJ, Brazil); MNRJ (Museu Nacional do Rio de Janeiro, RJ, Brazil); MZUSP (Museu de Zoologia, Universidade de São Paulo, SP, Brazil); SPCS (Sérgio POTSCH DE CARVALHO E SILVA Collection, Universidade Federal do Rio de Janeiro, RJ, Brazil); UFV (Museu de História Natural, Universidade Federal de Viçosa, MG, Brazil). Specimens examined are listed in app. 1.

Measurements, in millimeters, are: SVL (snout-vent length); HL (head length); HW (head width); IND (internarial distance); END (eye to nostril distance); ED (eye diameter); UEW (upper eyelid width); IOD (interorbital distance); THL (thigh length); TL (tibia length); FL (foot length).

NOMENCLATURAL HISTORY

Each of the five names proposed for a member of the genus *Chiasmocleis* occurring in the Atlantic Rain Forest is discussed in chronological order.

ENGYSTOMA LEUCOSTICTUM BOULENGER, 1888

This species was described on the basis of a female specimen (type not stated; BMNH 88.4.23.3 registered as holotype, according to FROST, 1985) collected at "Sierra do Catharina, Province Santa Catharina, Brazil" (BOULENGER, 1888). Currently this locality is in the Catarina Mountain Range, in the state of Santa Catarina, southern Brazil. PARKER (1934) transferred the species to the genus *Chiasmocleis*, under the combination *Chiasmocleis leucosticta*.

CHIASMOCLEIS BICEGOI MIRANDA-RIBEIRO, 1920

The species was described based on a single specimen from "Os Perus, S. Paulo" (MIRANDA-RIBEIRO, 1920). Currently, this locality is a suburb within the western side of the city of São Paulo, state of São Paulo, Brazil. The holotype (MZUSP 924, formerly MZUSP 595), a juvenile (15.0 mm SVL) of undetermined sex, is in very poor condition, totally discoloured, the ventral and pectoral regions dilacerated, and arms and legs almost totally destroyed. Direct comparison of the holotype of *C. bicegoi* with a recently collected young specimen of *Chiasmocleis albopunctata* Boettger, 1885, obtained at Iperó, state of São Paulo (MNRJ 17324, 13.9 mm SVL), indicates that the former is a junior synonym of the latter. *Chiasmocleis albopunctata* is an open area inhabitant, occurring in the "cerrados" of Brazil in the states of São Paulo, Minas Gerais, Goiás, Mato Grosso, Mato Grosso do Sul, and Distrito Federal, and in Paraguay and Bolivia. Iperó is about 90 km from the type locality of *C. bicegoi*, and it is perfectly acceptable that the species occurred near the city of São Paulo at the end of the last century, when the holotype was collected by BICEGO. The shape of the snout, although with some deformation in the holotype of *C. bicegoi*, is coincident in both specimens; vestiges of the white blotches on the snout and dorsolateral region of the body

characteristic of *C. albopunctata* are still observed in the holotype of *C. bicegoi*. Thus, synonymization of *C. bicegoi* with *C. albopunctata* renders it extralimital for the present work. The citation of *C. bicegoi* for Itaguaí, state of Rio de Janeiro, by BOGART & NELSON (1976) applies to a new species described in the account below.

NECTODACTYLUS SPINULOSUS MIRANDA-RIBEIRO, 1924

The genus *Nectodactylus* was proposed by MIRANDA-RIBEIRO (1924) to accomodate a new species, named *N. spinulosus* (syntypes MNRJ 525 and 5582), from "Humboldt – Sta. Catharina – Brasilia" (currently Corupá, state of Santa Catarina, Brazil). The genus was synonymized with *Chiasmocleis* by PARKER (1934), resulting in the combination *Chiasmocleis spinulosa*. Later, CARVALHO (1954) synonymized *Nectodactylus spinulosus* with *Engystoma leucostictum*, thus recognizing *Chiasmocleis leucosticta* as the valid name for the species.

CHIASMOCLEIS SCHUBARTI BOKERMANN, 1952

The species was described based on a young specimen (holotype MZUSP 2309) from "Córrego Juncado, Linhares", state of Espírito Santo, Brazil (BOKERMANN, 1952). This is a perfectly valid and recognizable species.

CHIASMOCLEIS URBANAE BOKERMANN, 1952

The species was described on the basis of a purported male specimen (holotype MZUSP 9033) from "Ilha de São Sebastião", on the coast of the state of São Paulo, Brazil (BOKERMANN, 1952). *Chiasmocleis urbanae* was synonymized with *C. leucosticta* by BOKERMANN (1966); this action was not recognized in FROST (1985), where *C. urbanae* was treated as a valid species. Examination of the holotype of *C. urbanae* showed it to be a female specimen and identical to specimens of *C. leucosticta* from the state of Santa Catarina and the southern portion of the state of São Paulo. Consequently, we agree with BOKERMANN (1966) and consider *C. urbanae* to be a synonym of *C. leucosticta*.

SPECIES ACCOUNTS

Chiasmocleis leucosticta (Boulenger, 1888)

Engystoma leucostictum Boulenger, 1888.
Chiasmocleis leucosticta: PARKER, 1934.
Nectodactylus spinulosus Miranda-Ribeiro, 1924.
Chiasmocleis spinulosa: PARKER, 1934.
Chiasmocleis urbanae Bokermann, 1952.

Diagnosis. – A medium sized species of *Chiasmocleis* diagnosed by the following combination of characters: (1) SVL 19.0-22.8 mm in males, 21.8-25.5 mm in females; (2) body trunk ovoid;

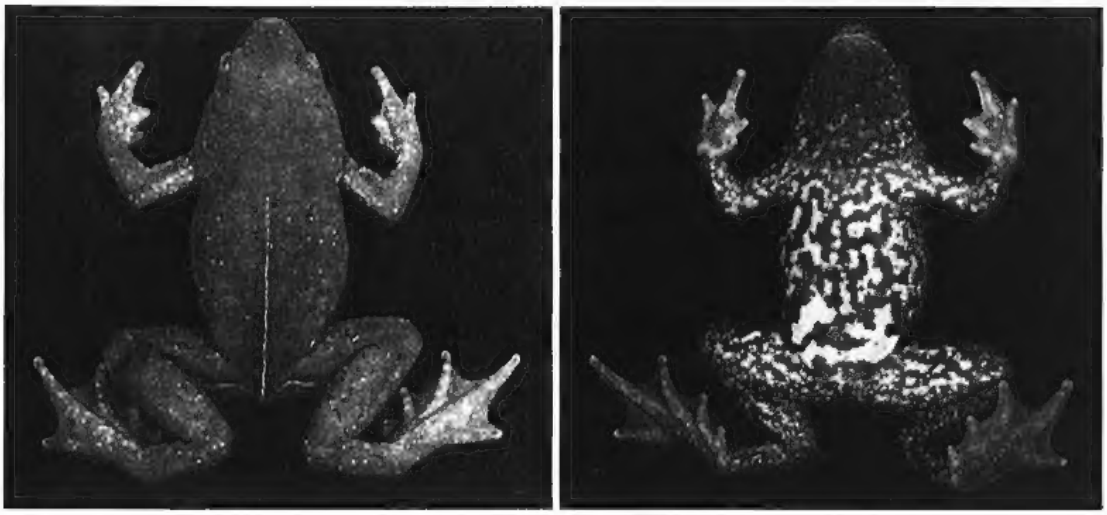

Fig. 1. – Dorsal and ventral views of *Chiasmocleis leucosticta* (Boulenger, 1888) (MNRJ 17901).

(3) snout short, tip slightly truncate in dorsal view, and slightly protruding in lateral profile; (4) hand and foot of male webbed, of female half webbed; (5) fingers and toes lacking disks, fringed on free parts in females; (6) fingers and toes with few, small lateral dermal spines only in males; (7) dorsal surfaces with small dermal spines; (8) in preservative, color on dorsum dark brown with small white dots irregularly distributed, and a light longitudinal mid-dorsal line; (9) posterior sides of legs with a light longitudinal line; (10) venter roughly marbled in dark brown and pale cream.

Description. – Size medium for the genus; body trunk ovoid (fig. 1); head short, as broad as long; nostrils at the tip of snout, not protuberant, and directed laterally; snout short, tip slightly truncate in dorsal view (fig. 2 A), and slightly protruding in lateral profile (fig. 2 B); internarial distance smaller than eye to nostril distance, and only slightly smaller than eye diameter; eye diameter less than eye to nostril distance; canthus rostralis only slightly defined; loreal region oblique, flat; lips not flared; eyes small, only slightly protruding; upper eyelid width one third of the interorbital space; interorbital area flat; cranial crests and occipital fold absent; postorbital fold present; tympanum absent; upper jaw projecting beyond lower; mandible with truncate, trilobed anterior margin; tongue large, ovoid; choanae small, rounded, widely separated; a small, subgular vocal sac present.

Arms slender, lacking tubercles and crests on forearm. Hand of male (fig. 2 C) webbed, of female (fig. 3 A) half webbed; fingers lacking disks, fringed on free parts in females, with lateral dermal spines only in males; finger length I < II < IV < III; subarticular tubercles well developed, rounded; supernumerary tubercles absent; palmar tubercle large, divided in two parts; thenar tubercle large, rounded, at the base of finger I.

Legs short, robust; knee and heel lacking tubercles; tibial and tarsal ridges absent. Foot of male (fig. 2 D) webbed, of female (fig. 3 B) half webbed; toes lacking disks and fringed on free parts; toe length I < II < V < III < IV; toes with few, small lateral dermal spines in males,

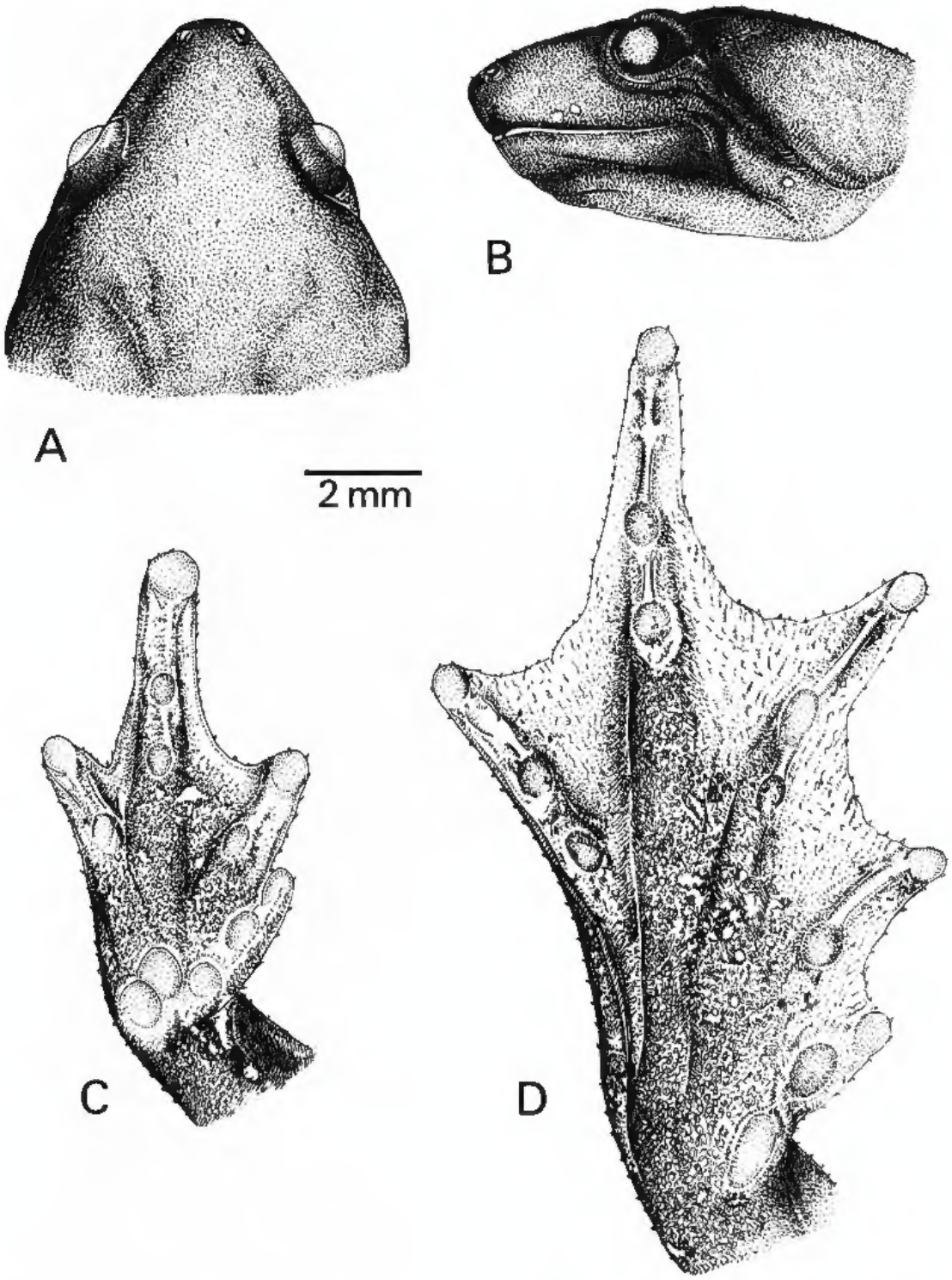

Fig. 2. – *Chiasmocleis leucosticta* (Boulenger, 1888), male (MNRJ 17901). Dorsal (A) and ventral (B) views of head. Hand (C). Foot (D).

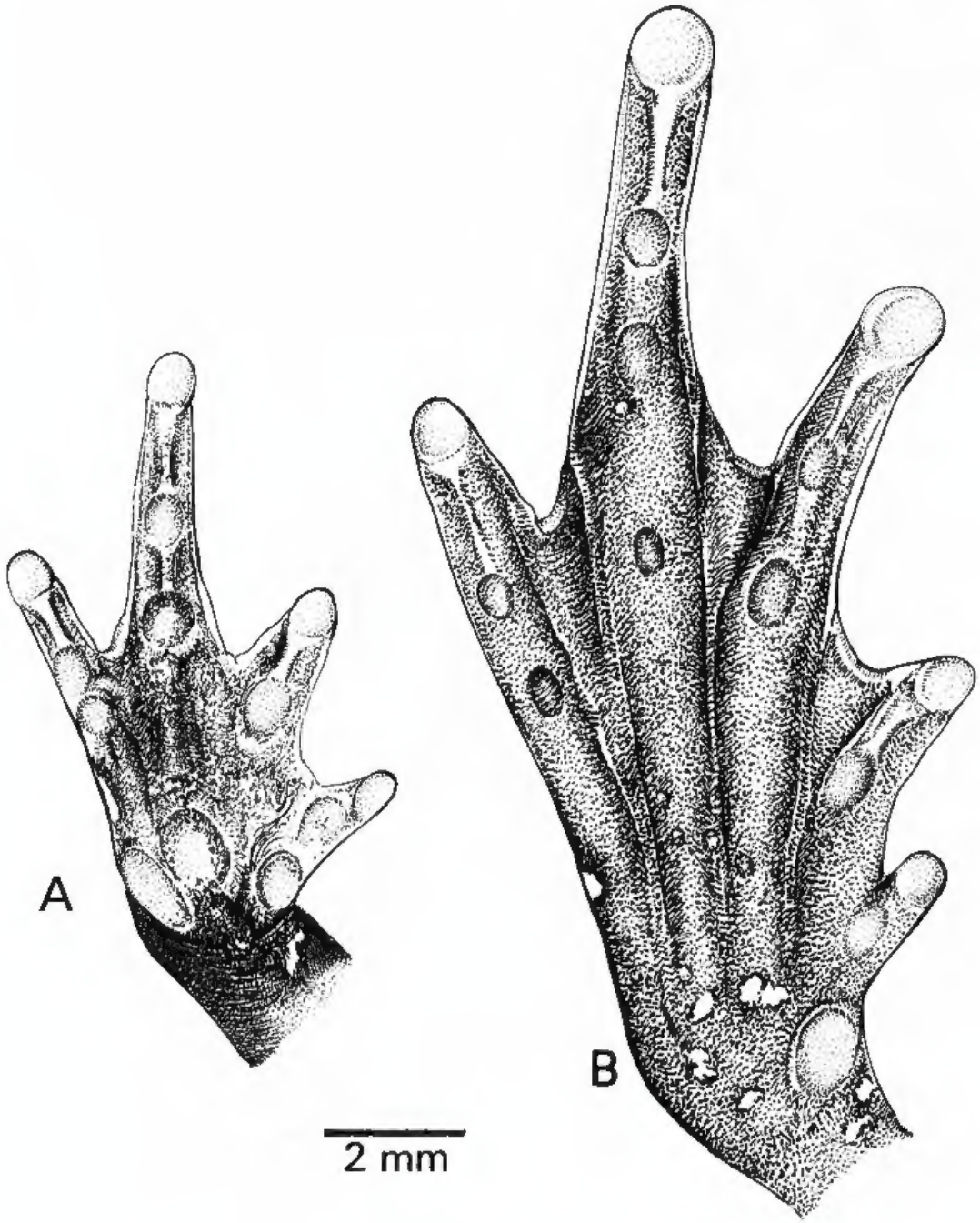

Fig. 3. – *Chiasmocleis leucosticta* (Boulenger, 1888), female (MNRJ 17902). Hand (A). Foot (B).

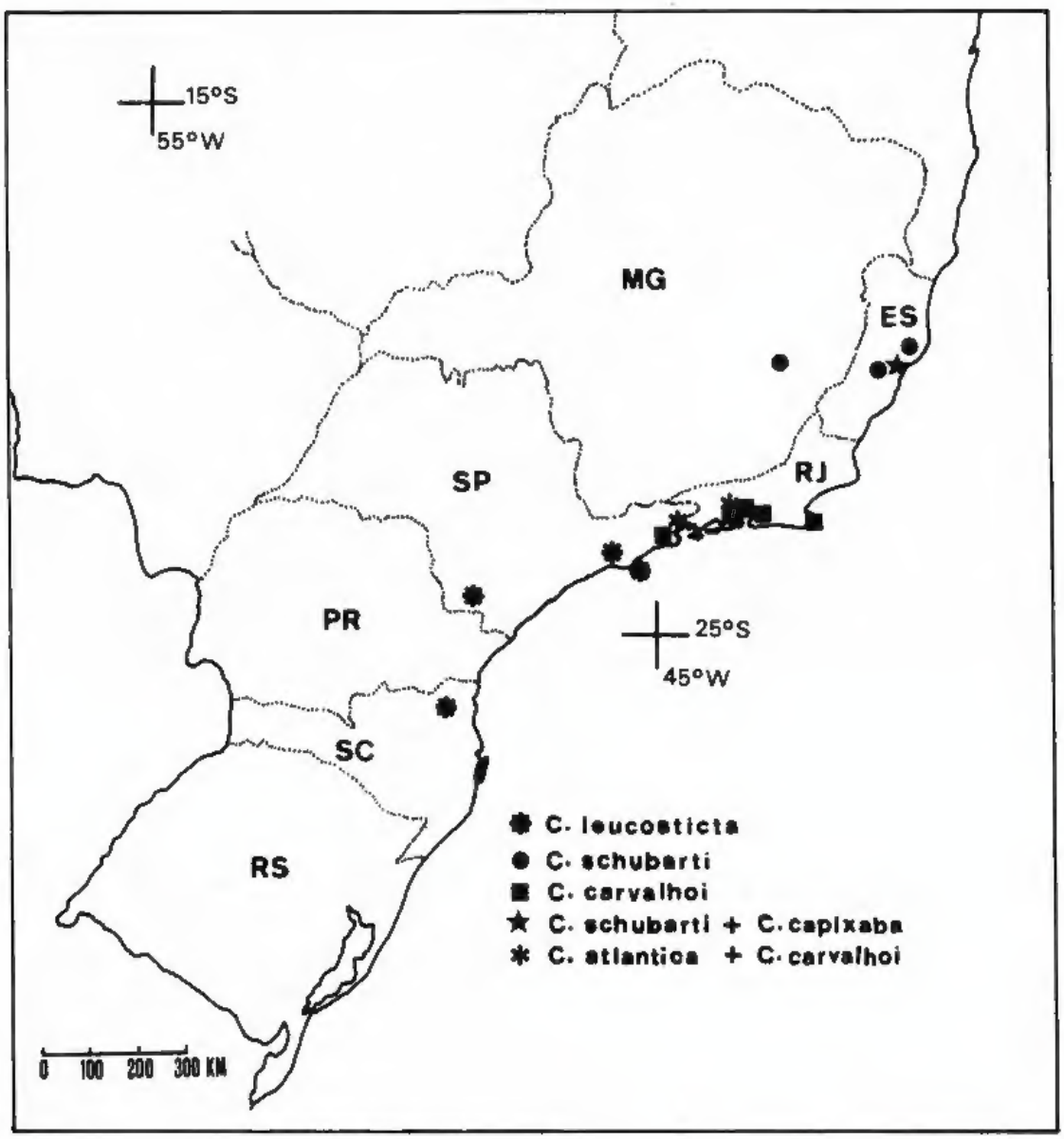

Fig. 4. – Geographical distribution of the species of *Chiasmocleis* in the Atlantic Rain Forest of Brazil (states of southeastern and southern regions of Brazil: MG, Minas Gerais; ES, Espírito Santo; RJ, Rio de Janeiro; SP, São Paulo; PR; Paraná; SC, Santa Catarina; RS, Rio Grande do Sul).

lacking in females; subarticular tubercles well developed, rounded; supernumerary tubercles absent; an oval inner, but no outer, metatarsal tubercle. Thigh length slightly less than tibia length; knee and elbow widely separated with limbs adpressed to sides of body; combined thigh and tibia length approximately 83 % of snout-vent length in males, 85 % in females; heels slightly superposed when flexed legs held at right angles to body; foot length approximately 66 % of snout-vent length in males, 69 % in females.

Skin smooth above and beneath; dorsal and ventral surfaces of body and limbs with small, uniformly distributed dermal spines, more numerous in males. Anal opening not modified, lacking para-anal tubercles and glands around anus.

In preservative (70 % ETOH), color on dorsum dark brown with small white dots irregularly distributed; a light longitudinal mid-dorsal line meeting, above the anus, another light longitudinal line present on the posterior sides of legs. Venter roughly marbled in dark brown and pale cream; male throat infuscated.

Variation. – Variation in measurements is presented in tab. 1. Females are larger than males, with interdigital webbing less developed. In some females, a light line is present on ventral surface of arms and pectoral region, where it assumes a V-shape, crossed by a perpendicular light longitudinal mid-ventral line.

Geographical distribution. – Known from the states of São Paulo and Santa Catarina, in southeastern and southern Brazil (fig. 4). The occurrence of the species in the state of Paraná is predictable.

Remarks. – Specimens of *C. leucosticta* were collected in temporary ponds inside the forest, from about 30 to 800 m above sea level. The reproduction is explosive, when numerous male and female specimens congregate at the reproductive sites. KASAHARA & HADDAD (1997) reported a population of *C. leucosticta* from Ribeirão Branco, state of São Paulo, to be tetraploid (4 n = 48).

Chiasmocleis schubarti Bokermann, 1952

Chiasmocleis schubarti Bokermann, 1952.

Diagnosis. – A medium sized species of *Chiasmocleis* diagnosed by the following combination of characters: (1) SVL 19.2-26.3 mm in males, 20.4-34.5 mm in females; (2) body trunk ovoid; (3) snout short, tip rounded in dorsal and lateral profile; (4) hand not webbed, foot only slightly webbed at the base of toes in both sexes; (5) fingers and toes lacking disks, slightly fringed; (6) fingers and toes of males with small, lateral dermal spines, absent in females; (7) dorsal and ventral surfaces of body and limbs with small, uniformly distributed dermal spines in males, absent in females except in anal region; (8) in preservative, color on dorsum uniformly dark brown; (9) posterior sides of thighs with a light longitudinal line; (10) venter roughly marbled in dark brown and pale cream.

Description. – Size medium for the genus; body trunk ovoid (fig. 5); head short, broader than long; nostrils near the tip of snout, not protuberant, and directed laterally; snout short, tip rounded in dorsal and lateral profile (fig. 6 A-B); internarial distance smaller than eye to nostril distance, and slightly larger than eye diameter; eye diameter less than eye to nostril distance; canthus rostralis only slightly defined; loreal region oblique, flat; lips not flared; eyes small, only slightly protruding; upper eyelid width one third of the interorbital space; interorbital area flat; cranial crests and occipital fold absent; postorbital fold present; tympanum absent; upper jaw projecting beyond lower; mandible with truncate, trilobed anterior margin; tongue large, ovoid; choanae small, rounded, widely separated; a small, subgular vocal sac present.

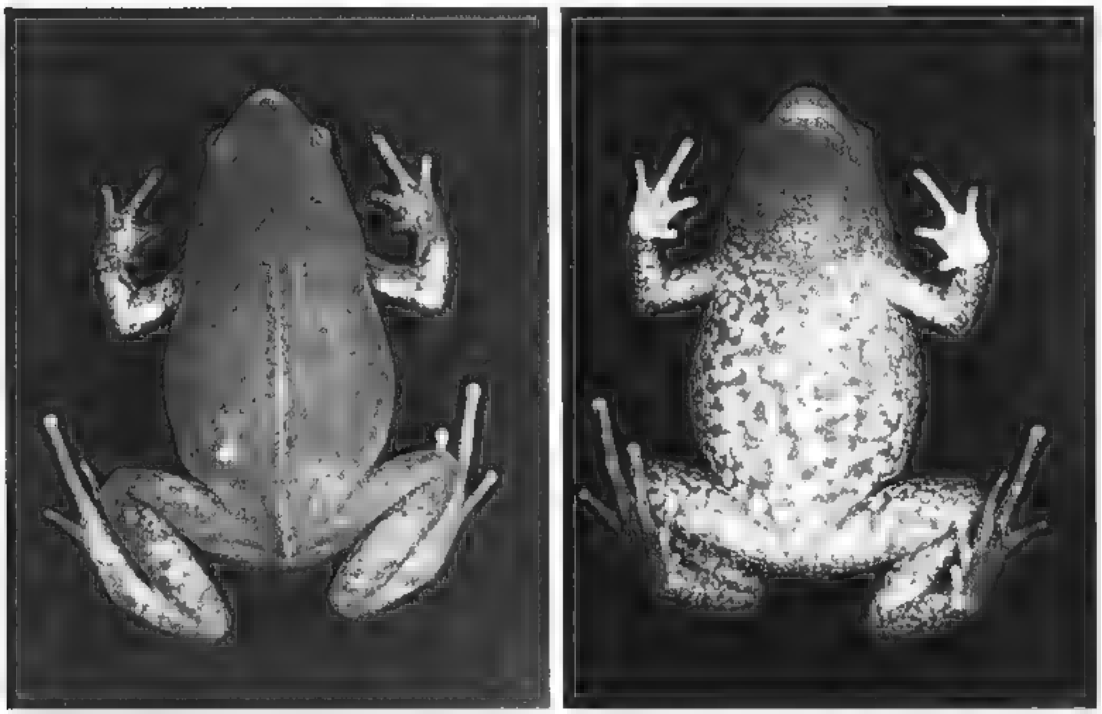

Fig. 5 – Dorsal and ventral views of *Chiasmocleis schubarti* Bokermann, 1952 (MNRJ 17538).

Arms slender, lacking tubercles and crests on forearm. Hand (fig. 6 C) not webbed in both sexes; fingers lacking disks, slightly fringed; fingers with small, lateral dermal spines in males, absent in females; finger length I < II < IV < III; subarticular tubercles well developed, rounded; supernumerary tubercles absent; palmar tubercle large, divided in two parts; thenar tubercle small, rounded, at the base of finger I.

Legs short, robust; knee and heel lacking tubercles; tibial and tarsal ridges absent. Foot (fig. 6 D) only slightly webbed at the base of toes in both sexes; toes lacking disks, slightly fringed; toe length I < II < V < III < IV; toes with small, lateral dermal spines in males, absent in females; subarticular tubercles well developed, rounded; supernumerary tubercles absent; a small, rounded inner, but no outer, metatarsal tubercle. Thigh length slightly less than tibia length; knee and elbow widely separated with limbs adpressed to sides of body; combined thigh and tibia length approximately 85 % of snout-vent length in males, 82 % in females, heels slightly superposed when flexed legs held at right angles to body; foot length approximately 70 % of snout-vent length in males, 64 % in females.

Skin smooth above and beneath; dorsal and ventral surfaces of body and limbs with small, uniformly distributed dermal spines in males, absent in females except in anal region. Anal opening not modified, lacking para-anal tubercles and glands around anus.

In preservative (70 % ETOH), color on dorsum dark brown; irregular white blotches on outer surfaces of arms and forearms; dorsal surfaces of hands and feet with small white dots

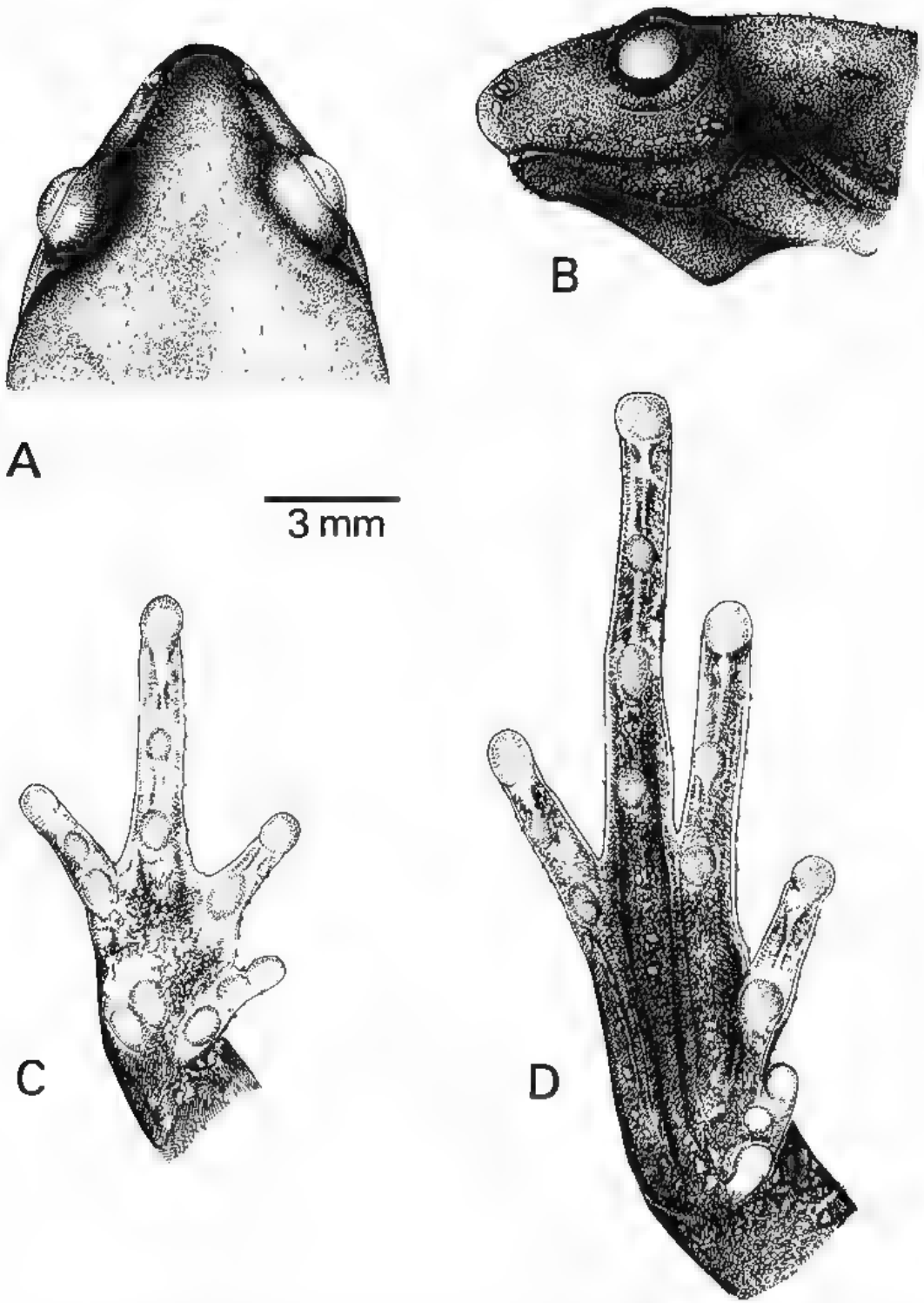

Fig. 6. – *Chiasmocleis schubarti* Bokermann, 1952 (MNRJ 17538). Dorsal (A) and ventral (B) views of head. Hand (C). Foot (D).

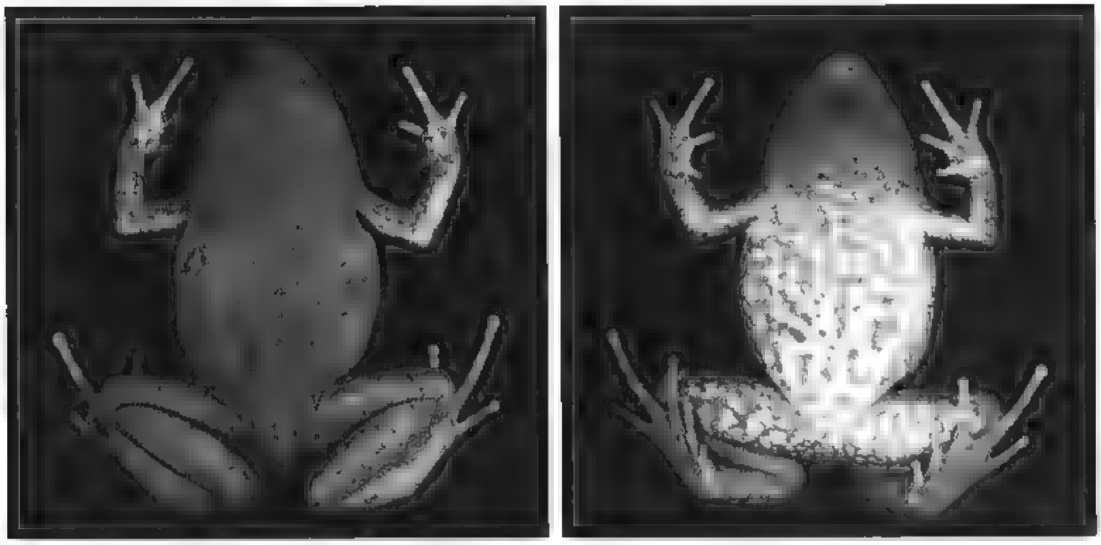

Fig. 7 – Dorsal and ventral views of *Chiasmocleis atlantica* sp. nov (MNRJ 17550, holotype).

irregularly distributed; a light longitudinal line on the posterior sides of thighs. Venter roughly marbled in dark brown and pale cream, male throat infuscated.

Variation. – Variation in measurements is presented in tab. 1. In some specimens, a light longitudinal mid-dorsal line is present.

Geographical distribution. – Known from the states of Espírito Santo and Minas Gerais in southeastern Brazil (fig. 4).

Remarks. Scattered specimens of *C. schubarti* were collected in pitfall traps installed in low and highland forests, 40 and 800 m above sea level. Explosive reproduction, when numerous male and female specimens congregate, was observed in temporary ponds inside the forest. KASAHARA & HADDAD (1997) reported a diploid number of 24 chromosomes for this species.

Chiasmocleis atlantica sp. nov.

Holotype. - MNRJ 17550, adult male, collected at Tinguá (22°36'S, 43°26'W; ca. 40 m altitude), municipality of Nova Iguaçu, state of Rio de Janeiro, Brazil, on 27 December 1972, by C. A. G. DA CRUZ, S. D. L. RAIMUNDO, J. G. SILVA and E. IZECKSOHN.

Paratopotypes. – MNRJ 17551-17554 and EI 8940-8954, collected with the holotype; MNRJ 17549, on 30 January 1971, by J. JIM, V. C. JESUS and E. IZECKSOHN.

Diagnosis. – A medium sized species of *Chiasmocleis* diagnosed by the following combination of characters: (1) SVL 22.0-25.0 mm in males, 30.0-31.8 mm in females; (2) body trunk ovoid; (3) snout short, tip truncate in dorsal view, and slightly protruding in lateral profile; (4) hand and foot not webbed, (5) fingers and toes lacking disks, slightly fringed; (6) fingers and toes of

males with lateral dermal spines, absent in females; (7) dorsal and ventral surfaces of body and limbs with uniformly distributed dermal spines in males, absent in females except in anal region; (8) in preservative, color on dorsum uniformly brown; (9) posterior sides of thighs with a light longitudinal line; (10) venter roughly marbled in brown and pale cream.

Description. – Size medium for the genus; body trunk ovoid (fig. 7); head short, wider than long; nostrils at the tip of snout, not protuberant, and directed laterally; snout short, tip truncate in dorsal view (fig. 8 A), and slightly protruding in lateral profile (fig. 8 B); internarial distance smaller than eye to nostril distance, and larger than eye diameter; eye diameter less than eye to nostril distance; canthus rostralis slightly defined; loreal region almost vertical, slightly concave; lips not flared; eyes small, only slightly protruding; upper eyelid width one third of the interorbital space; interorbital area flat; cranial crests and occipital fold absent; postorbital fold well developed; tympanum absent; upper jaw slightly projecting beyond lower; mandible with truncate, trilobed anterior margin; tongue large, ovoid; choanae small, rounded, widely separated; a small, subgular vocal sac present.

Arms slender, lacking tubercles and crests on forearm. Hand (fig. 8 C) not webbed in both sexes; fingers lacking disks, slightly fringed; fingers with lateral dermal spines in males, absent in females; finger length I < II < IV < III; subarticular tubercles well developed, rounded; supernumerary tubercles absent; palmar tubercle large, divided in two parts; thenar tubercle small, rounded, at the base of finger I.

Legs short, robust; knee and heel lacking tubercles; tibial and tarsal ridges absent. Foot (fig. 8 D) only slightly webbed at the base of toes in both sexes; toes lacking disks, slightly fringed; toe length I < II < V < III < IV; toes with lateral dermal spines in males, absent in females; subarticular tubercles well developed, rounded; supernumerary tubercles absent; a small, oval inner, but no outer, metatarsal tubercle. Thigh length slightly less than tibia length; knee and elbow widely separated with limbs adpressed to sides of body; combined thigh and tibia length approximately 87 % of snout-vent length in males, 78 % in females; heels slightly superposed when flexed legs held at right angles to body; foot length approximately 70 % of snout-vent length in males, 67 % in females.

Skin poorly rugose above and smooth beneath; dorsal and ventral surfaces of body and limbs with uniformly distributed dermal spines in males, absent in females except in anal region. Anal opening not modified, lacking para-anal tubercles and glands around anus.

In preservative (70 % ETOH), color on dorsum uniformly brown; dorsal surfaces of hands and feet with small white dots irregularly distributed; a light longitudinal line on the posterior sides of thighs. Venter roughly marbled in brown and pale cream; male throat infuscated.

Measurements of holotype. – SVL 22.8; HL 6.9; HW 8.0; IND 2.0; END 2.0; ED 2 0; UEW 1.0; IOD 2.7; THL 10.4; TL 10.7; FL 16.7.

Variation. – Variation in measurements is presented in tab. 1. In some specimens, a light longitudinal mid-dorsal line is present.

Etymology. – The specific name, a Latin adjective, refers to the Atlantic Rain Forest of eastern Brazil

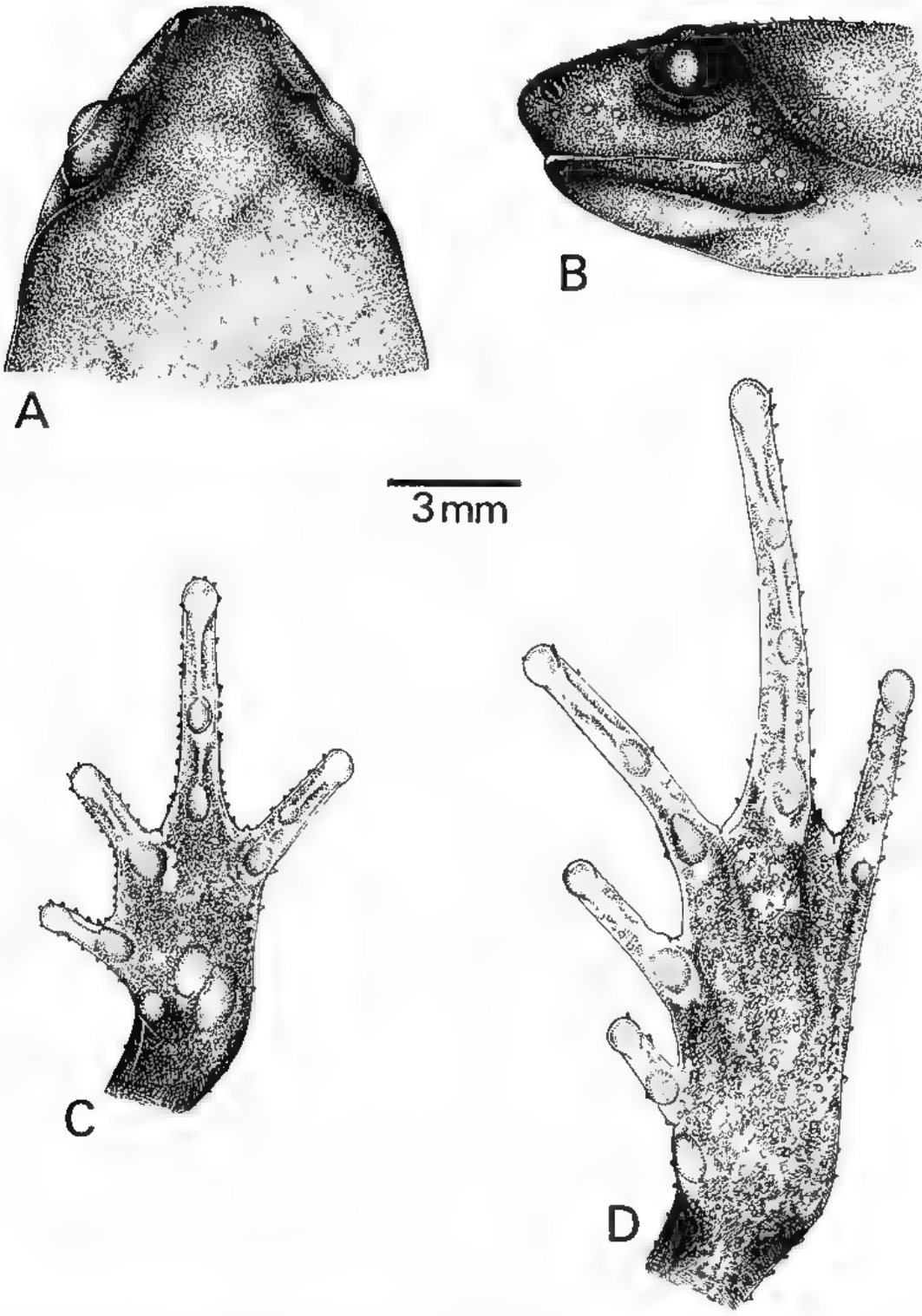

Fig. 8. *Chiasmocleis atlantica* sp. nov. (MNRJ 17550, holotype) Dorsal (A) and ventral (B) views of head. Hand (C). Foot (D).

Geographical distribution. – Known from the states of Rio de Janeiro and São Paulo in southeastern Brazil (fig. 4).

Remarks Specimens of *C. atlantica* were collected in lowland forests, at 40 m above sea level. Explosive reproduction, when numerous male and female specimens congregate, was observed in temporary ponds inside the forest.

Chiasmocleis capixaba sp. nov.

Holotype. – MNRJ 17514, adult male, collected at the municipality of Aracruz (19°59'S, 40°12'W; ca. 60 m altitude), state of Espírito Santo, Brazil, on 29 November 1995, by J. L. Gasparini.

Paratopotypes. – MNRJ 17515-17529, collected with the holotype; MNRJ 17532-17534, on 2-5 November 1994, by R. P. Bastos and J. L. Gasparini; MNRJ 17891-17895, on 29 November - 1 December 1995, by J. L. Gasparini; MNRJ 17535-17537, on 15-17 January 1996, by J. P. Pombal Jr., C. F. B. Haddad and J. L. Gasparini; EI 8955-8956, on 20-25 November 1994, by R. P. Bastos and J. L. Gasparini, CFBH 2668-2669, on 20-25 November 1994, by R. P. Bastos and J. L. Gasparini; CFBH 2685, on 23-27 January 1995, by J. P. Pombal Jr., J. L. Gasparini and C. F. B. Haddad, CFBH 2693-2695, on 27 November 1995, by J. L. Gasparini; CFBH 2701-2702, on 30 November 1995, by J. L. Gasparini; CFBH 2714, on 20 December 1995, by J. L. Gasparini.

Diagnosis. A small sized species of *Chiasmocleis* diagnosed by the following combination of characters: (1) SVL 14.7-16.5 mm in males, 17.9-21.7 mm in females; (2) body trunk elongate ovoid; (3) snout short, tip rounded in dorsal and lateral views, (4) hand not webbed, and foot webbed in both sexes; (5) fingers and toes lacking disks, extensively fringed on free parts; (6) fingers and toes of males with lateral dermal spines, absent in females; (7) dorsal and ventral surfaces of body and limbs with small, uniformly distributed dermal spines in males, absent in females except in anal region; (8) in preservative, color on dorsum grayish brown with gray blotches irregularly distributed; (9) posterior sides of legs with or without a light longitudinal line; (10) venter finely marbled in brown and pale cream.

Description. Size small for the genus; body trunk elongate ovoid (fig. 9); head short, approximately as broad as long; nostrils at the tip of snout, not protuberant, and directed anterolaterally; snout short, tip rounded in dorsal and lateral views (fig. 10 A-B); internarial distance equal eye diameter, smaller than eye to nostril distance; canthus rostralis rounded; loreal region oblique, slightly concave; lips not flared; eyes small, only slightly protruding; upper eyelid width smaller than half of the interorbital space; interorbital area flat; cranial crests and occipital fold absent; postorbital fold present, tympanum absent; upper jaw slightly projecting beyond lower; mandible with truncate, trilobed anterior margin; tongue large, ovoid; choanae small, rounded, widely separated; a small, subgular vocal sac present.

Arms slender, lacking tubercles and crests on forearm. Hand (fig. 10 C) not webbed in both sexes, fingers lacking disks, extensively fringed; fingers of males with lateral dermal spines, absent in females; finger length I < II < IV < III; subarticular tubercles well developed, rounded; supernumerary tubercles absent; palmar tubercle large, divided in two parts; thenar tubercle large, rounded, at the base of finger I.

Fig. 9 Dorsal and ventral views of *Chiasmocleis capixaba* sp. nov. (MNRJ 17514, holotype).

Legs short, robust; knee and heel lacking tubercles; tibial and tarsal ridges absent. Foot of male (fig. 10 D) extensively webbed, of female webbed only at the base of toes; toes lacking disks and fringed on free parts; toe length I < II < V < III < IV; toes with lateral dermal spines in males, absent in females; subarticular tubercles well developed, rounded; supernumerary tubercles absent; an oval inner, but no outer, metatarsal tubercle. Thigh length slightly longer than tibia length in males, and slightly less in females; knee and elbow widely separated with limbs adpressed to sides of body; combined thigh and tibia length approximately 79 % of snout-vent length in males, 74 % in females; heels slightly superposed when flexed legs held at right angles to body; foot length approximately 66 % of snout-vent length in males, 59 % in females.

Skin smooth above and beneath; dorsal and ventral surfaces of body and limbs with small, uniformly distributed dermal spines in males, absent in females except in anal region. Anal opening not modified, lacking para-anal tubercles and glands around anus.

In preservative (70 % ETOH), color on dorsum grayish brown with gray blotches irregularly distributed; loreal region dark gray; a light longitudinal mid-dorsal line on body and a similar line on the posterior sides of thighs present or absent. Ventral surfaces of body and limbs finely marbled in brown and pale cream; male throat infuscated.

Measurements of holotype. – SVL 15.5; HL 5.0, HW 5.2; IND 1.0; END 1.3; ED 1.4; UEW 1.0; IOD 1.8; THL 6.4; TL 6.6; FL 10.3.

Variation. – Variation in measurements is presented in tab. 1. Females are larger than males, with interdigital webbing less developed. The light mid-dorsal longitudinal line on body and the similar line on posterior surfaces of thighs are observed in approximately half of the examined specimens. These lines appear associated with a light line on ventral surfaces of arms and pectoral region, where it assumes a V-shape.

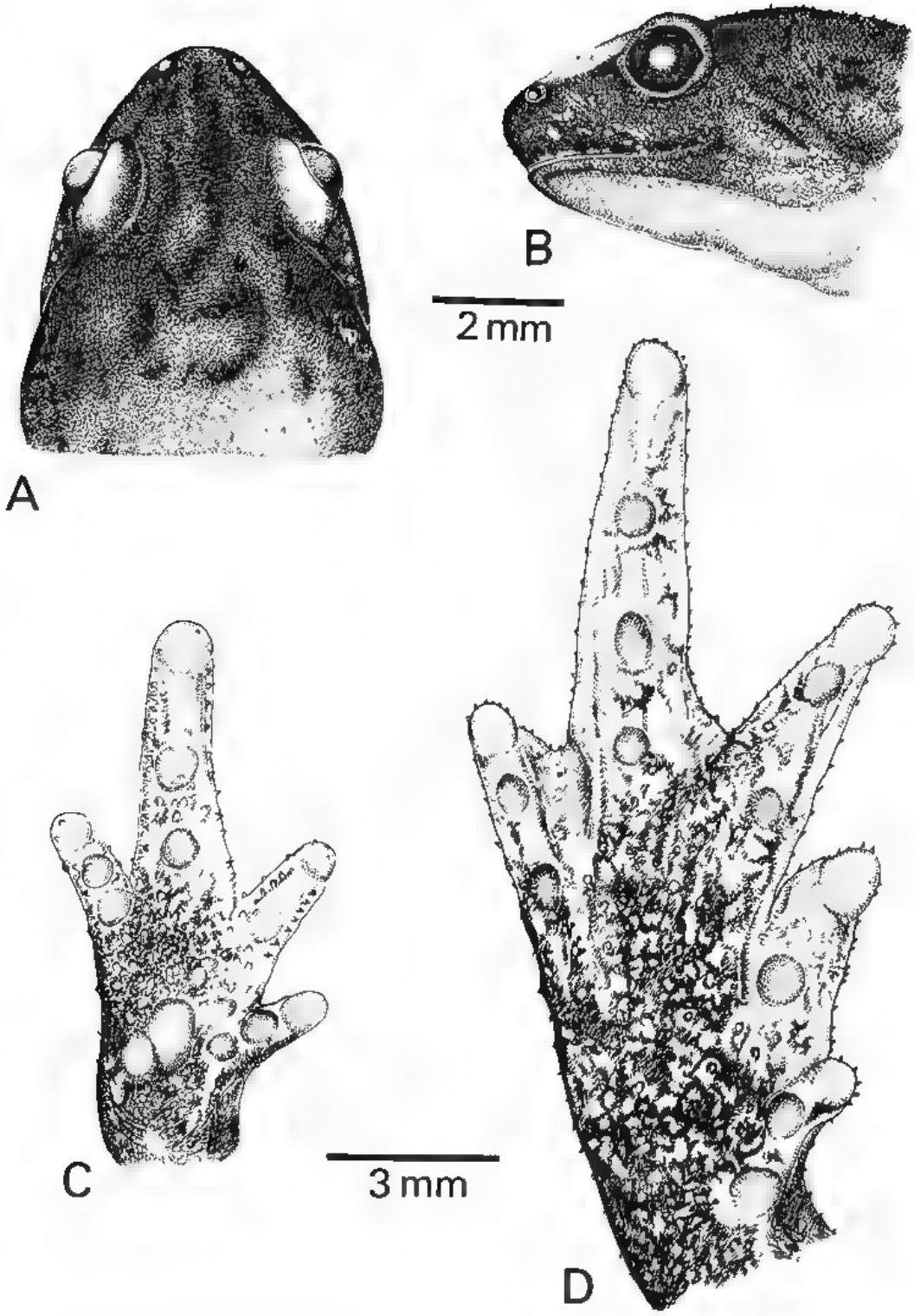

Fig 10. - *Chiasmocleis capixaba* sp. nov (MNRJ 17514, holotype) Dorsal (A) and ventral (B) views of head. Hand (C). Foot (D).

Etymology. – The name of the species, a native Brazilian word here utilized as a noun in apposition, refers to the occurrence of the species as an inhabitant of the state of Espírito Santo.

Geographical distribution. – Known only from the state of Espírito Santo in southeastern Brazil (fig. 4).

Remarks. – Scattered specimens of *C. capixaba* were collected in pitfall traps installed in lowland forests, at 60 m above sea level. Explosive reproduction, when numerous male and female specimens congregate, was observed in temporary ponds inside the forest

Chiasmocleis carvalhoi sp. nov.

Holotype. – MNRJ 17505, adult male, collected at the Horto Florestal de Santa Cruz, municipality of Seropédica (22°44'S, 43°43'W, ca. 40 m altitude), state of Rio de Janeiro, Brazil, on 31 January 1995, by C. A. G. DA CRUZ, L. KRAUSE and G. VINCIPROVA.

Paratopotypes. – MNRJ 17506-17513 and 17565, collected with the holotype; MNRJ 17480-17504, on 2 December 1968, by E. IZECKSOHN, S. T. ALBUQUERQUE and J. SAMARÃO; EI 2096-2235, on 21 February 1964, by J. JIM and E. IZECKSOHN; EI 2236-2307, on November 1964, by J. JIM, S. T. ALBUQUERQUE, W. F. MENDONÇA and E. IZECKSOHN; EI 2308-2399, on December 1964, by J. JIM, S. T. ALBUQUERQUE, W. F. MENDONÇA and E. IZECKSOHN; EI 4381-4389, on December 1965, by S. T. ALBUQUERQUE, W. F. MENDONÇA, A. LEBEDENCO, J. JIM and E. IZECKSOHN; EI 4391-4393, on 19 October 1966, by S. T. ALBUQUERQUE, W. F. MENDONÇA and E. IZECKSOHN; EI 5332, on 17 September 1975, by E. IZECKSOHN and J. G. SILVA; EI 8937-8938, on 30 November 1979, by I. FERREIRA.

Diagnosis. – A small sized species of *Chiasmocleis* diagnosed by the following combination of characters: (1) SVL 15.5-18.3 mm in males, 16.0-22.5 mm in females; (2) body trunk ovoid; (3) snout short, tip rounded in dorsal and lateral views; (4) hand and foot not webbed in both sexes; (5) fingers and toes lacking disks, fringed, (6) fingers and toes with lateral dermal spines in males, absent in females; (7) dorsal and ventral surfaces of body and limbs with small, uniformly distributed dermal spines in males, absent in females except in anal region; (8) in preservative, color on dorsum brown with small white dots irregularly distributed; (9) posterior sides of legs with or without a light longitudinal line; (10) venter finely marbled in brown and pale cream.

Description. – Size small for the genus; body trunk ovoid (fig. 11); head short, slightly broader than long; nostrils at the tip of snout, not protuberant, and directed anterolaterally; snout short, tip rounded in dorsal and lateral views (fig. 12 A-B); internarial distance equal eye diameter, smaller than eye to nostril distance; canthus rostralis rounded; loreal region oblique, slightly concave; lips not flared; eyes small, slightly protruding; upper eyelid width smaller than half of the interorbital space; interorbital area flat; cranial crests and occipital fold absent; postorbital fold present; tympanum absent; upper jaw slightly projecting beyond lower; mandible with truncate, trilobed anterior margin, tongue large, ovoid; choanae small, rounded, widely separated; a small, subgular vocal sac present.

Fig. 11. – Dorsal and ventral views of *Chiasmocleis carvalhoi* sp. nov. (MNRJ 17505, holotype).

Arms slender, lacking tubercles and crests on forearm. Hand (fig. 12 C) not webbed in both sexes; fingers lacking disks, fringed; fingers of males with lateral dermal spines, absent in females; finger length I < II < IV < III; subarticular tubercles well developed, rounded; supernumerary tubercles absent; palmar tubercle large, divided in two parts; thenar tubercle small, rounded, at the base of finger I.

Legs short, robust; knee and heel lacking tubercles, tibial and tarsal ridges absent. Foot (fig. 12 D) not webbed in both sexes; toes lacking disks, fringed; toe length I < II < V < III < IV; toes with lateral dermal spines in males, absent in females; subarticular tubercles well developed, rounded; supernumerary tubercles absent; an oval inner, but no outer, metatarsal tubercle. Thigh length less than tibia length; knee and elbow widely separated with limbs adpressed to sides of body; combined thigh and tibia length approximately 82 % of snout-vent length in males, 79 % in females; heels slightly superposed when flexed legs held at right angles to body; foot length approximately 66 % of snout-vent length in males, 62 % in females.

Skin smooth above and beneath; dorsal and ventral surfaces of body and limbs with small, uniformly distributed dermal spines in males, absent in females except in anal region. Anal opening not modified, lacking para-anal tubercles and glands around anus.

In preservative (70 % ETOH), color on dorsum brown with small white dots irregularly distributed; a light longitudinal mid-dorsal line on body, and a similar line on the posterior sides of thighs, present or absent. Ventral surfaces of body and limbs finely marbled in brown and pale cream; male throat infuscated.

Measurements of holotype. – SVL 17.3; HL 5.6; HW 5.3; IND 1.3; END 1.6; ED 1.5; UEW 1.0; IOD 2.2; THL 7.2; TL 7.4; FL 11.6.

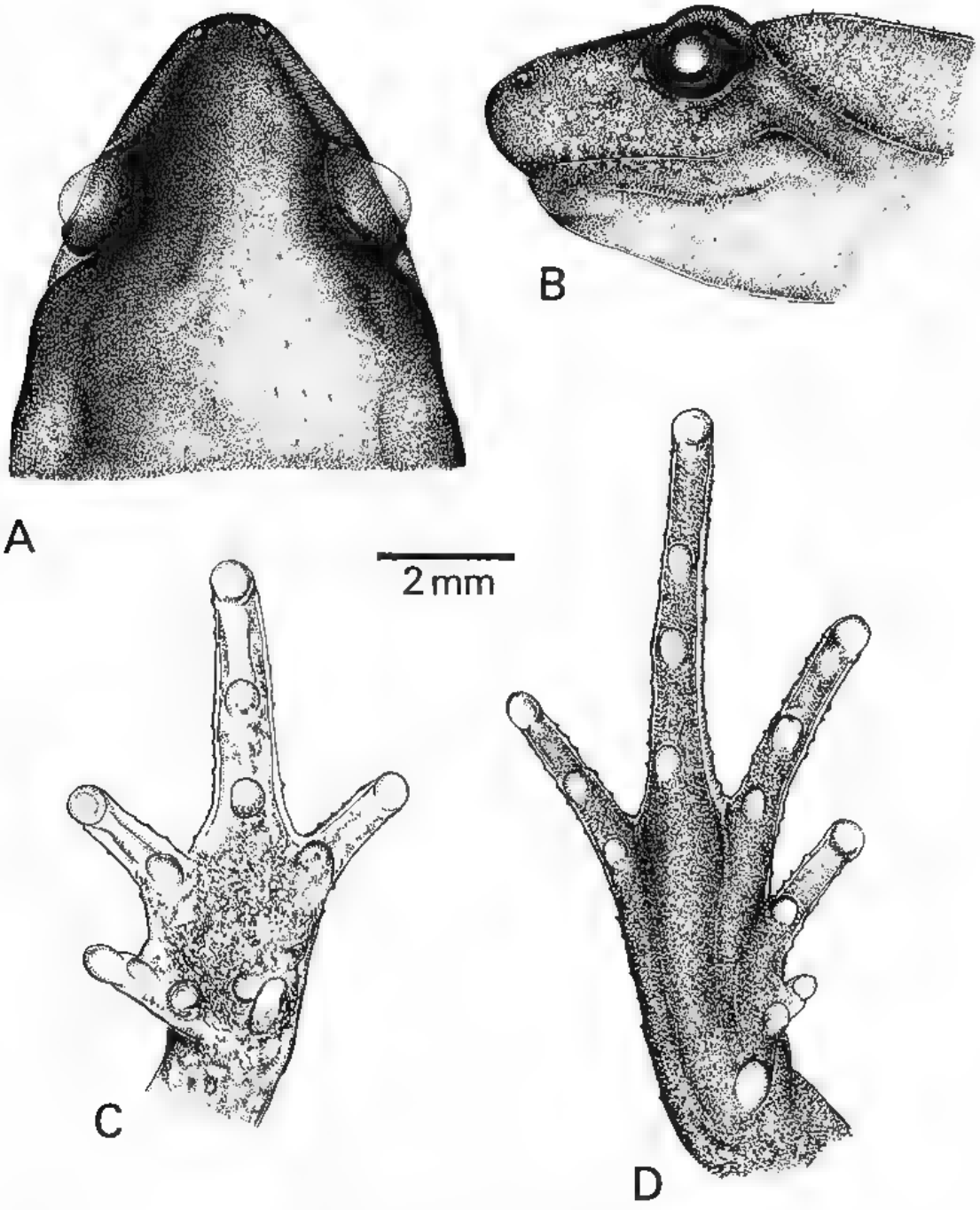

Fig. 12. – *Chiasmocleis carvalhoi* sp. nov. (MNRJ 17505, holotype). Dorsal (A) and ventral (B) views of head. Hand (C). Foot (D).

Variation. – Variation in measurements is presented in tab. 1. A light mid-dorsal longitudinal line on body and a similar line on posterior surfaces of thighs are observed in some specimens. These lines appear associated with a light line on ventral surfaces of arms and pectoral region, where it assumes a V-shape.

Etymology. – The name of the species honors the late Prof. Antenor Leitão DE CARVALHO (1910-1985), an outstanding teacher, naturalist, and herpetologist.

Geographical distribution. – Known from the states of Rio de Janeiro and São Paulo in southeastern Brazil (fig. 4)

Remarks. – Specimens of *C. carvalhoi* were collected in lowland forests, at 40 m above sea level. Explosive reproduction, when numerous male and female specimens congregate, was observed in temporary ponds inside the forest. BOGART & NELSON (1976) referred to a diploid number of 24 chromosomes for specimens identified as *C. bicegoi*, collected at Itaguaí, state of Rio de Janeiro. This reference applies to *C. carvalhoi*.

DISCUSSION

Species of *Chiasmocleis* occurring in the Atlantic Rain Forest are readily separated in two morphologically distinct groups. The first grouping involves *C. leucosticta* and *C. capixaba*, characterized by the presence of well developed webbing on the feet. The second grouping includes *C. schubarti*, *C. atlantica*, and *C. carvalhoi*, with no or only vestigial web on the feet.

Chiasmocleis leucosticta is larger than *C. capixaba* (see tab. 1), and males of the former have a fully webbed hand instead of the absence of webbing observed in *C. capixaba*. The latter species has a finely marbled venter with males presenting numerous, conspicuous lateral dermal spines on digits, whereas *C. leucosticta* presents a roughly marbled venter and small dermal spines on digits. The geographical distribution of these two species is largely disjunct (see fig. 4).

The striking webbing observed in *C. leucosticta* and *C. capixaba* is found in only one other species of the genus, *C. anatipes*, described by WALKER & DUELLMAN (1974) from Santa Cecilia, Ecuador. As noted by these authors, in the event that generic distinction should be desirable for the fully foot-webbed species, the name *Nectodactylus* Miranda-Ribeiro, 1924 (type-species *N. spinulosus*, a junior synonym of *C. leucosticta*) is available.

In the second grouping, *C. carvalhoi* is smaller than *C. schubarti* and *C. atlantica* (see tab. 1), and presents a finely marbled venter instead of the roughly marbled venter found in the other two species. *Chiasmocleis schubarti* presents the snout rounded in dorsal and lateral views, and *C. atlantica* has the snout truncate in dorsal and slightly protruding in lateral views. Moreover, males of *C. atlantica* have numerous, conspicuous lateral dermal spines on digits, whereas *C. schubarti* presents few, small lateral spines on those digits. *Chiasmocleis atlantica* and *C. carvalhoi* are sympatric, and both are disjunctly distributed in relation to *C. schubarti* and *C. leucosticta*. On the other hand, *C. schubarti* is sympatric with *C. capixaba*, and largely disjunct from *C. leucosticta* (see fig. 4).

Tab. 1 - Measurements of five species of the genus *Chiasmocleis* Méhely, 1904 from the Atlantic Rain Forest of Brazil: *Chiasmocleis leucosticta* (Boulenger, 1888), *Chiasmocleis schubarti* Bokermann, 1952; *Chiasmocleis atlantica* sp nov ; *Chiasmocleis capixaba* sp. nov.; *Chiasmocleis carvalhoi* sp. nov. *n*, number of specimens; *x*, mean; *s*, standard deviation.

	Chiasmocleis leucosticta (Boulenger, 1888)			*Chiasmocleis schubarti* Bokermann, 1952			*Chiasmocleis atlantica* sp. nov.			*Chiasmocleis capixaba* sp. nov.			*Chiasmocleis carvalhoi* sp. nov.		
Males	*n* = 12			*n* = 15			*n* = 20			*n* = 12			*n* = 15		
Characters	Range	*x*	*s*	Range	*x*	*s*	Range	*x*	*s*	Range	*x*	*s*	Range	*x*	*s*
SVL	19.0-22.8	20.0	1.26	19.2-26.3	23.5	1.87	22.0-25.0	23 1	0.80	14.7 16.5	15.6	0 58	15.5-18.3	17 1	0.76
HL	5.4-7.0	6.0	0.47	6.1-7.7	6.7	0.56	5.4-8.1	6.8	0.65	4.2-5.4	4.8	0.42	4.3-6.0	5.2	0.46
HW	5.3-6.5	5.8	0.36	5.8-8.1	7.2	0.61	6.8-8.4	7.4	0.41	4.6-5 3	4.9	0.21	4.4-6.1	5.3	0.40
IND	1.2-1.6	1.5	0.11	1.4-2.1	1.9	0.20	1.2-2.0	1.6	0.21	1.0-1.4	1.2	0.14	1.0-1.4	1.3	0.14
END	1.6-2.0	1.7	0.12	1.7-2.3	2.1	0.14	1.4-2.3	1.9	0.23	1.2-2 0	1.5	0.22	1.4-2.3	1.7	0.23
ED	1.3-1.6	1.5	0.11	1.3-2.0	1.6	0.24	1.0-1.5	1.3	0.22	1.0-1.4	1.2	0.16	1.0-1.5	1.3	0.16
UEW	0.6-1.0	0.9	0.12	0.9-1.2	1.0	0.07	1.0-1.2	1.0	0.06	0.6-1 0	0.9	0.18	0.8-1.0	0.9	0.10
IOD	2.0-2.8	2 4	0.22	2 3-3.3	2.9	0.27	2 6-3.3	2.9	0.18	1.8-2.3	2.0	0 19	2 0-2.3	2.1	0.11
THL	7.8-9.1	8.3	0.33	8.1-11.1	9.4	0.78	9.0-10.7	9.9	0.46	5.4-7.0	6.3	0.48	6.0-7.3	6.8	0.41
TL	7 8-9.6	8 8	0.47	8.7-11.2	10.1	0.74	9.8-11.4	10 6	0.42	5.1-7 0	6.2	0.58	6 6-7.8	7.3	0.32
FL	11.9-15.6	13.4	0.88	14.5-17.5	15.9	1.04	11.7-17.8	16.5	1.31	9.5-11.2	10.3	0.45	10.0-12.6	11.3	0 78
Females	*n* = 15			*n* = 12			*n* = 3			*n* = 16			*n* = 15		
Characters	Range	*x*	*s*	Range	*x*	*s*	Range	*x*	*s*	Range	*x*	*s*	Range	*x*	*s*
SVL	21.8-25.5	23.6	1.15	20 4-34.5	28.7	4.60	30.0-31.8	30.6	1.04	17.9-21.7	20.2	1.01	16.0-22.5	20.2	1.93
HL	5 7 7 5	6 8	0.52	5 6-8 2	7 4	0 87	6 6-7.8	7.3	0.61	4.4-6 7	5.7	0.64	4.2-6.6	5.5	0.66
HW	5.7-7.4	6.4	0.45	6.2-10.2	8.0	1.15	8.1-8.2	8.1	0.06	5.4-6.2	5.7	0.22	5.0-6.4	5.6	0.40
IND	1.3-2 0	1 6	0.15	1 6-2 2	1 9	0.23	1 8-2.4	2.1	0.31	1.0-1.4	1.2	0.15	1.2-1 6	1 4	0.15
END	1.7-2 2	1.9	0.14	2.0-2.6	2 2	0.19	1.9-2.4	2.1	0.25	1.4-1 8	1.6	0.10	1.4-2.0	1.8	0.20
ED	1.4-2.0	1.6	0.18	1.4-2.0	1.8	0.24	1.6-2.0	1.8	0.21	1.0-1.9	1.3	0.21	1.0-2.0	1 4	0.30
UEW	0.7-1 3	1.0	0 12	0.9-1.4	1.1	0.16	1 1-1 4	1.3	0.15	0.7-1 0	0.9	0.09	0.8-1 0	1 0	0.07
IOD	2.5-3.0	2.7	0.18	2.7-3.7	2.2	0.29	3.6-3.7	3.7	0.06	2.0-2.9	2.4	0.20	2.1-3.0	2.4	0.28
THL	9 0 10 5	10.0	0 42	8 4-13 5	11.1	1 51	11 5-12 3	11 8	0.44	6 7-8.0	7.3	0.43	6.2-9.1	7.6	0.73
TL	9 3-11 0	10.3	0 46	9 4-13 8	11.9	1.39	11.8-12.8	12 3	0.50	6.4-8.3	7.5	0.61	6.5-9 1	7.9	0.70
FL	15.1-17.4	16.3	0.77	14.1-20.7	18.1	2 19	20.0-21.2	20.5	0.61	10.6-12.8	12.0	0.77	9.9-14.2	12.3	1.21

Résumé

L'étude taxinomique des espèces du genre *Chiasmocleis* de la Forêt Atlantique brésilienne est presentée. *Chiasmocleis bicegoi* Miranda-Ribeiro, 1920 est mise en synonymie de *C. albopunctata* (Boettger, 1885), une espèce distribuée hors des limites géographiques considérées dans le présent travail. La synonymisation de *C. urbanae* Bokermann, 1952 avec *C. leucosticta* (Boulenger, 1888) est confirmée. Une description détaillée de *C. leucosticta* et de *C. schubarti* Bokermann, 1952 est fournie. Trois nouvelles espèces sont décrites.

Resumo

O estudo taxonômico das espécies do gênero *Chiasmocleis* que ocorrem na Floresta Atlântica do leste do Brasil é apresentado. *Chiasmocleis bicegoi* Miranda-Ribeiro, 1920 é sinonimizada com *C. albopunctata* (Boettger, 1885) e considerada fora da delimitação geográfica abrangida pelo presente trabalho. A sinonimização de *C. urbanae* Bokermann, 1952 com *C. leucosticta* (Boulenger, 1888) é reafirmada. *Chiasmocleis leucosticta* e *C. schubarti* Bokermann, 1952 são redescritas e três espécies novas são descritas.

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APPENDIX 1

LIST OF SPECIMENS EXAMINED

Chiasmocleis leucosticta. – BRAZIL: *São Paulo*: Casa Grande (MNRJ 17564), Ribeirão Branco (MNRJ 17900-17904, CFBH 268, 2136, 2229-2232, 2234, 2236-2237, 2239-2243, 2245-2247, 2251-2652; EI 8957-8958); Ilha de São Sebastião (MZUSP 9033, holotype of *Chiasmocleis urbanae*); *Santa Catarina* Corupá (MNRJ 525, 5582, syntypes of *Nectodactylus spinulosus*); Santa Luzia e Araujos (MNRJ 17563).

Chiasmocleis schubarti. – BRAZIL: *Espirito Santo*: Linhares, Córrego Juncado (MZUSP 2309, holotype); Linhares, Sooretama (EI 2095; MNRJ 17548); Santa Teresa (EI 8939); Aracruz (MNRJ 17538, 17539, 17542-17545, 17546, 17547, 17896-17899; CFBH 2667, 2703-2704, 2710-2713; EI 8959-8960); *Minas Gerais*: Marliéria, Parque Estadual do Rio Doce (MNRJ 17883-17890; UFV 2600-2601, 2603-2608, 2610, 2612-2615, 2617-2618).

Chiasmocleis atlantica. – BRAZIL: *Rio de Janeiro*. Nova Iguaçu, Tinguá (MNRJ 17550, holotype; MNRJ 17549, 17551-17554, paratypes; EI 8940-8954, paratypes); *São Paulo*: Ubatuba, Picinguaba (SPCS 5605-5607).

Chiasmocleis capixaba. – BRAZIL: *Espírito Santo*. Aracruz (MNRJ 17514, holotype, EI 8955-8956, paratypes; MNRJ 17515-17529, 17532-17534, 17535-17537, 17891-17895, paratypes; CFBH 2668-2669, 2685, 2693-2695, 2701-2702, 2714, paratypes).

Chiasmocleis carvalhoi. - BRAZIL *Rio de Janeiro*: Seropédica, Horto Florestal de Santa Cruz (MNRJ 17505, holotype; MNRJ 17480-17504, 17506-17513, 17565, paratypes, EI 2096-2235, 2236-2307, 2308-2399, 4381-4389, 4391-4393, 5332, 8937-8938, paratypes); Arraial do Cabo, Ilha de Cabo Frio (MNRJ 17555-17562); Duque de Caxias (MNRJ 17566-17567, 17568-17571, 17572, 17573-17575, 17576); Niterói (MNRJ 17577, 17578), Nova Iguaçu, Tinguá (EI 4378, 4379, 4380, 4390, 4394); *São Paulo*: Ubatuba (CFBH 1322, 1571); Ubatuba, Picinguaba (SPCS 5608-5610, 5612-5613, 5617, 5620-5621).

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